



### Key Accomplishments

1. Processing technologies developed for very high voltage normally-off SiC power VJFET fabrication.
2. MJTE edge termination technology developed for over 10kV SiC diodes and switches.
3. Implant conditions optimized and lateral channel mobility of  $\sim 400 \text{ cm}^2/\text{Vs}$  achieved.
4. 800V-1.2kV and 3 kV normally-off VJFETs fabricated and achieved world record performances.
3. Fabricated and published the world's first 10 kV-1A SiC Schottky diode with  $R_{\text{SP\_ON}} = 97 \text{ m}\Omega \text{ cm}^2$ .
4. Fabricated and published the world's first 11 kV SiC VJFET (normally-off) with  $R_{\text{SP\_ON}} = 131 \text{ m}\Omega \text{ cm}^2$  with low leakage current density of  $1 \text{ mA}/\text{cm}^2$  at 11kV.
5. 10kV SiC normally-off VJFETs achieved  $0.05 \text{ mA}/\text{cm}^2$  leakage current density at 10kV, exceeding program target of  $1 \text{ mA}/\text{cm}^2$  at 10kV.

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### Goals, Objectives and Main Technical Approach

1. Developing critical SiC processing technologies and optimum designs for the fabrication of oxide-free 4H-SiC power switches based on VJFETs targeting up to 10 kV in Phase I and 10 kV-100A in Phase II.
2. Optimizing implant conditions to maximize channel mobility;
3. Fabricating and evaluating lateral JFETs suitable for correlating processing conditions and channel mobility;
4. Developing and improving multi-MeV ion implantation technology for scaling up blocking voltage of VJFETs;
5. Optimizing 4H-SiC VJFET design through computer modeling;
6. Integrating advanced processing technologies to demonstrate 4H-SiC VJFETs targeting 800V-1,200V, 3kV and 10kV.

### Major Impact of Technology & Technology Transition Plan

1. Providing an alternate to MOSFET-based unipolar power switch for high-temperature applications;
2. Providing multi-MeV ion implant technology suitable for scaling up the power rating of the VJFET;
3. Providing process technology for maximizing channel mobility;
4. Providing a process recipe for scaling normally-off VJFET to large area with high current;
5. Industry collaborator is now further improving the technologies for commercialization of SiC VJFETs